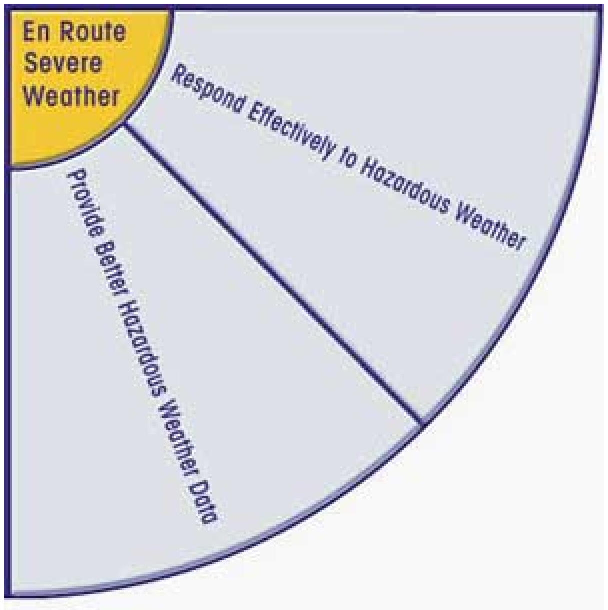
Objective: Increase User Flexibility to Manage Contingencies

Load Scenario Review Problem



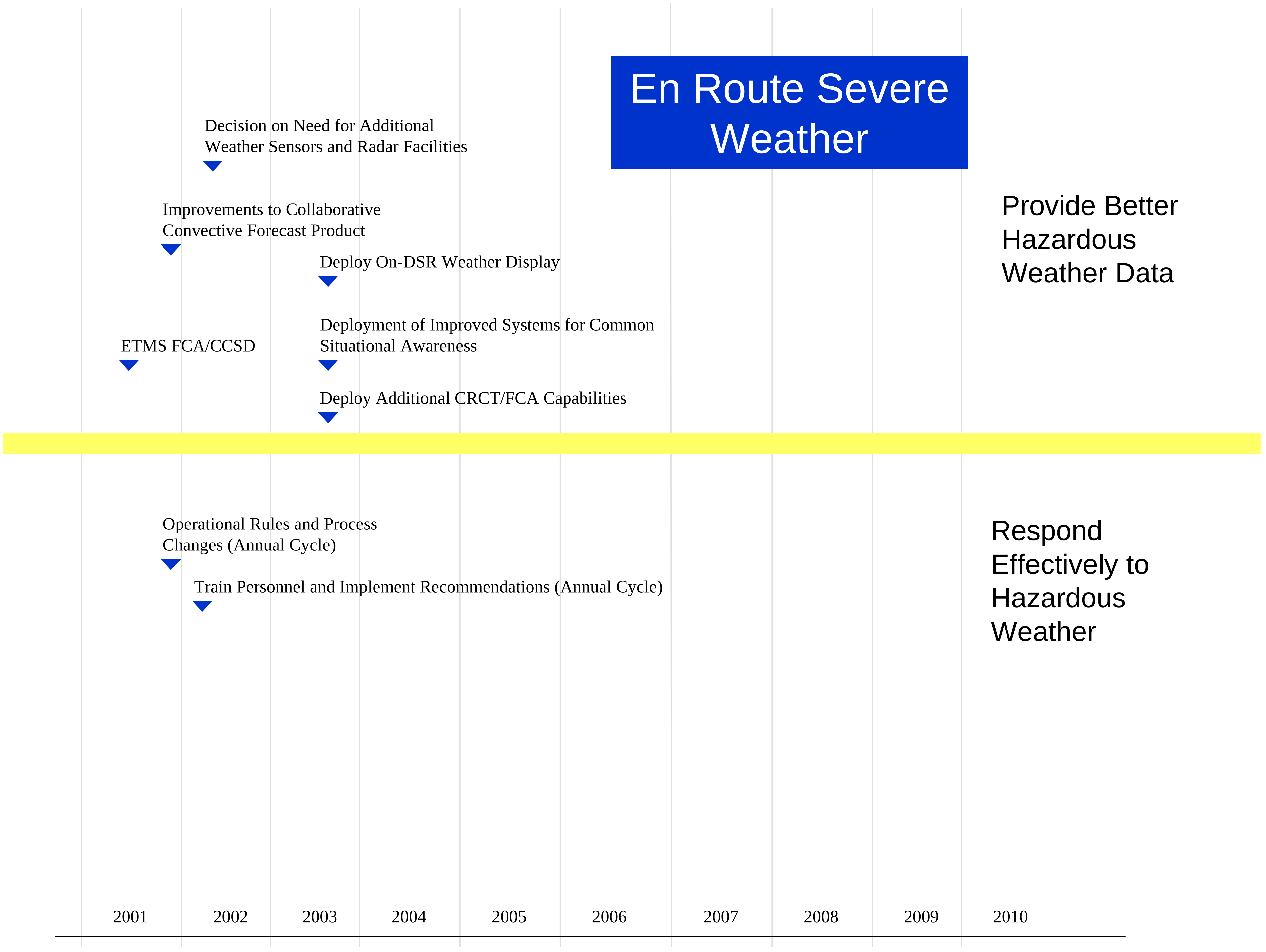
Benefits Costs Timeline

Severe weather in en route airspace blocks access to flights; most of the delay is caused by convective thunderstorms that cross west to east in large fronts throughout the summer. Prediction capabilities are imprecise, resulting in restrictions that are imposed too early or too late and flights that are cancelled unnecessarily. As a result half of the delays and most of the cancellations occur on about 60 days out of the year.

Better coordination of the decisions reached throughout the community will help reduce the unnecessary perturbations to the system when weather does not materialize or shows up other than at the forecast time and location. It has been estimated that at most 40% of the delays could be recovered.

Click on a "Wedge" to access the solution.

En Route Severe Weather



En Route Severe Weather - Benefits

Almost half of delays and cancellations experienced across the NAS are due to disruptions from en route severe weather and our inability to predict its location, movement, and severity. Today's forecasts are accurate less than a third of the time, meaning many restrictions and cancellations are mistimed or done for improper locations. Collaboration on plans and more precise identification of flights that would be impacted by severe weather will result in a relaxation and removal of miles-in-trail (MIT) volume restrictions, and improved re-routing/MIT assignment for those aircraft affected. Studies have shown that up to 40% of the delays and cancellations may be recoverable, but the actual percentages that will be achieved through OEP actions are uncertain. Estimates indicate the savings that can be achieved through the planned collaboration may be about half a million minutes per year, or approximately 7.5% of the delay during the severe weather season.

Solution: Provide Better Hazardous Weather Data

The disruptions caused by hazardous en route weather are magnified by the uncertainty in the location, movement, and severity of the weather conditions. Forecast accuracy is not well suited to the strategic planning of traffic flow decisions. Joint planning is further hindered by limitations in real-time data sharing capabilities. Operational decision making by airlines and traffic flow managers will be improved based on common awareness of the situation, coupled with the improved data exchange, training, and coordination processes which are being applied to the overall en route congestion problem.

Key Dates

ETMS FCA/CCSD	2001
Improvements to Collaborative Convective Forecast Product	2001
Decision on Need for Additional Weather Sensors and Radar Facilities	2002
Deploy On-DSR Weather Display	2003
Deployment of Improved Systems for Common Situational Awareness	2003
Deploy Additional CRCT/FCA Capabilities	2003

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Primary Office of Delivery

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Support Offices

ATP-1

ARW-1

AUA-400

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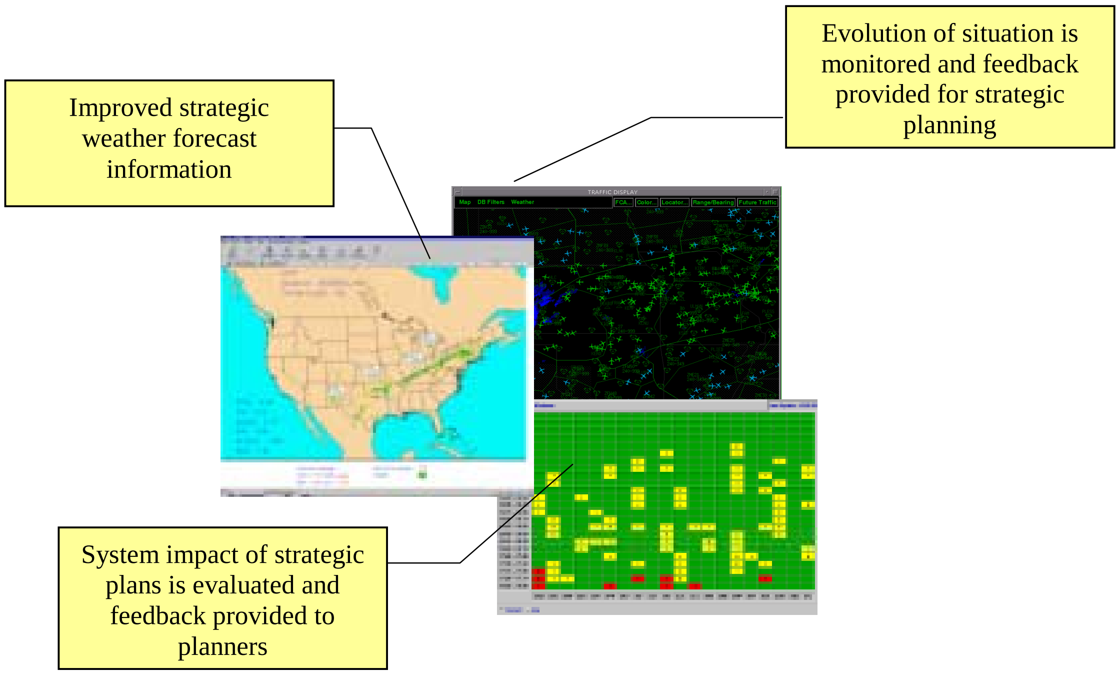
Other Websites

Please send your comments to nas-evol@mitre.org

This page was last updated on May 30, 2001

EW-1: Provide Better Hazardous Weather Data

Improved predictability in convective weather forecast products with respect to growth, decay, movement, intensity, and coverage of thunderstorm activity, which will lead to a more efficient operational response to the weather condition.



Background

Problems generated by en route hazardous weather involve uncertainties due to changes in NAS capacity and the often-unpredictable nature of convective weather. The convective weather forecast prediction accuracy is not well suited to the strategic planning time frame of traffic flow decisions. In addition, lack of forecast fidelity with respect to timing makes impacted flight identification difficult at best, leading to the belief by many that areas forecast to have convective activity, regardless of probability, need to be treated as "no fly zones" for the planning process. Additional difficulties arise from limited real-time, data sharing capabilities.

Ops Change Description

Improvements will be evolutionary and will span the near, mid, and long term timeframes. The key operational change is improving NAS predictability as a by-product of a high confidence level in the accuracy of convective weather forecasts. Operational change will be highly dependent on the state-of-the art science and research of forecasting convective weather growth, decay, movement, intensity, and coverage. Therefore, operational change with respect to common situational awareness, common data exchange, and operational significance of current forecast products (e.g., an understanding that the CCFP is for guidance and not for required compliance) should be improved through a focus on training and the SPT process (identified in smart sheet ER-2) while work continues on improving convective weather forecasting. The following sections address the operational changes described:

- EW-1.1: Improved weather reporting and forecasting.
- EW-1.2: Dissemination of common weather information.
- EW-1.3: More precise identification of flights to be impacted by severe weather.
- EW-1.4: Display detailed weather to controllers.

Benefit, Performance and Metrics

- Reduction in variance of execution against plan.
- Reduction in number and/or duration of ground delay programs in support of SWAP for en-route hazardous weather constraints.
- Reduction in the number and/or duration of ground stops due to hazardous en-route weather constraints. Reduction in fuel diversions due to hazardous weather encountered.
- Increased equity plus better plans equals an increase in system access/equity. This equity is achieved from narrowing the confidence gap that exists today from one system user to another or one FAA facility to another. Measurement of system access and area throughput along with analyzing user acceptance of the plan will determine forecast confidence.

EW-1.1 Improved Weather Reporting and Forecasting

Scope and Applicability

Near-Term:

- The Collaborative Convective Forecast Product (CCFP) is a collaborative product, developed by the Aviation Weather Center (AWC), Center Weather Service Units (CWSU), and Airline meteorological departments. Improvements in the collaboration, issuance times, and operational applications are currently under study for the year 2001 convective weather season.

Mid-Term/Long-Term:

- The FAA Aviation Weather Research Program (AWRP) has the lead for improved weather products and forecasting capabilities. Development of early and more precise identification of hazardous weather, to flights in the en-route environment, will lead to improved strategic planning and tactical applications of route management.

- Current AWRP product team research that applies to the en-route environment include:
  - Aviation Gridded Forecast System
    - Products: Aviation Digital Data Service
    - Real Time Verification System
  - In-flight Icing
    - Products: Integrated Icing Diagnosis Algorithm
    - Integrated Turbulence Forecasting Algorithm
  - Model Development and Enhancement
    - Products: Rapid Update Cycle
    - Weather Research and Forecasting
  - NEXRAD Enhancements
    - Products: Rapid Product Update
    - Convective Growth and Decay
    - Mesocyclone Detection
  - Convective Weather
    - Products: Terminal Convective Weather Forecast
    - National Convective Weather Forecast
    - Concept: Corridor Integrated Weather System, CIWS (funding and program location needed)
  - Turbulence
    - Products: Turbulence Forecasting Integrated Turbulence Forecast Algorithm
    - Turbulence Observation In-Situ Measurement and Reporting
- Integrated ground based and/or airborne sensor/system improvements applied to weather products and decision support systems (DSS). Candidate sensor and system applications include:
  - Operational and Supportability Improvement System (OASIS).
  - ASOS Controller Equipment – Information Display System (ACE-IDS).
  - Stand Alone Weather Sensor (SAWS).
  - Automated Weather Sensor System (AWSS).

- A combination of NEXRAD and ITWS data for the high traffic corridor between Chicago and the Northeast Airports providing full high definition color weather radar.

Key Decisions

- Installation of sensors or radar facilities as appropriate, including environmental impact studies.
- Increase adoption of user Pilot Reports programs (e.g., Northwest and United Airlines turbulence information programs).

Key Risks

- Funding of AWRP programs.
- Community roadblocks to radar or sensor installations.
- Operational significance of the anticipated improvements made to convective weather forecast.
- Speed of the research and development of weather sciences.
- National Weather Service cost/benefit analysis for producing additional aviation weather products and systems.
- Cost/benefit analysis for outfitting aircraft with additional weather sensing equipment.

EW-1.2 Dissemination of Common Weather Information

Scope and Applicability

Near-Term:

- Collaborative Convective Forecast Products (CCFP) dissemination and access improvements based on recommendations from Spring/Summer 2000 review for the broadest range of stakeholders. The focus on this effort is to ensure the CCFP is available on the ATCSCC web site and the Aviation Weather Center (AWC) web site.
- Runway Visual Range (RVR) information is currently being provided to users via the CDMNet. Two airports, Memphis and Boston are reporting for information only purposes but additional airports will be incorporated as data ports are added into the ETMS network.
- Identify policies, procedures, and issues that are barriers to exchange of weather information.

Mid- and Long-Term:

- Weather information use and dissemination that can be used to support strategic planning.

Key Decisions

- Weather research funding.
- Infrastructure needed for the dissemination of weather products and for system access (e.g., web access policies and/or exploration of other means of general distribution of community use weather products).

Key Risks

- Speed of improvements in the state-of-the-art of weather science.

EW-1.3 More Precise Identification of Flights to be Impacted by Severe Weather

Scope and Applicability

Near-Term:

- Flow Constrained Area (FCA) tool with additional CRCT capability will be implemented in ETMS. FCA's will provide identification of specific flights that will be affected by severe weather for more targeted resolutions.
- Policies, procedures, and practices for identifying and disseminating list of affected flights using FCA capabilities and reaching resolution on actions to be taken.
- A tool to provide Traffic Management Specialist capabilities to assess the impact of proposed flow management strategies on NAS flows.
- DSP assigns a departure time to achieve a constant flow of traffic over a common point. Runway and departure procedures must be considered for accurate projections.

Mid-Term:

- Additional flight filtering and CRCT re-route functionality will be implemented in ETMS.
- Automation development for communication flight plan changes quickly.

- Information to produce solutions to airspace capacity and en route weather constraint problems.

Key Decisions

- Early intent filings (e.g., proposed four hours prior to departure) by the NAS users, to enhance ETMS data quality, for improved flight identification and predictability.
- Define collaborative processes and procedures for using FCA capabilities in ETMS.

Key Risks

- Speed of the research and development of weather sciences.

EW-1.4 Display Detailed Weather to Controllers

Scope and Applicability

Mid-Term:

- Development of policies and procedures prior to implementation of weather display on DSR.
- Full deployment of baseline weather-on-controller-display (DSR) requirements (e.g., procedural changes) to ensure controller has accurate weather information from which to identify potential impact areas.
- AWRP is developing actions and milestones to achieve the objective for the mid term to long-term.

Key Decisions

- Roles and responsibilities with respect to hazardous weather avoidance (NATCA, TWU, ADF, ALPA, APA, NBAA, RAA).

Key Risks

- Agreement on roles, responsibilities, and accountability issues.
- Deployment of required interfaces (e.g., WARP/DSR) is complex process and may induce schedule delays and additional requirements (e.g., security).

V3.0 (30 May 2001)

EW-1: Provide Better Hazardous Weather Data Decision Tree

2002 | 2003 | 2004

Evaluate additional weather sensors or radar facilities

- Environmental Impacts
- Community Roadblocks
- Cost/Benefits of additional sensing equipment on aircraft

Community

Evaluate Weather Forecasting Products and Systems

- Cost/benefits
- Operational significance
- Prioritize Programs/systems

Community

Evaluate Additional CRCT Functionality

- Early intent flight filings/Data quality
- Define collaboration process for FCA/ CRCT in ETMS
- Identification, dissemination, and resolution of affected flights

Community

Infrastructure for dissemination and access of weather products

- Identify barriers
- Determine required interfaces
- Automated Communication
- Web Access

Community

Deploy On-DSR Weather Display

- ATM/ATC procedures
- Roles and responsibilities

FAA

Deploy Additional CRCT Functionality

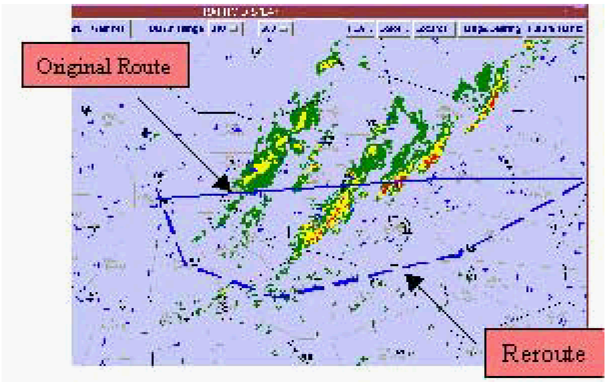
FAA

Deployment of Improved Systems for Common Situational Awareness

- Improved Strategic Decision Making

Community

Solution: Respond Effectively to Hazardous Weather



En Route

Managing the routes of aircraft, and particularly adjusting routes quickly to avoid hazardous weather conditions without disruptions to traffic flows, is difficult in today's environment. This leads to inefficient use of available airspace and unnecessary congestion and delays. Some sources of the difficulty are: rigid airspace and route structures; incompatibilities among automation systems used by airlines, aircraft flight management systems, and air traffic management; and cumbersome processes for modifying flight plans and communicating the changes quickly. Operationally, the solution involves improved weather prediction and forecast distribution, more flexibility in routing, faster identification of airspace and flights impacted by weather, common availability of current information among all participants in the planning process, and procedures and training to support the collaborative adjustment of routes to ensure safety while maintaining traffic flows. A program of training for controllers, pilots, and airline dispatchers has been instituted to prepare for the severe weather season of spring/summer 2001. Annual reviews of what works and what needs to be adjusted in the collaborative process will lead to continuing refinements each year.

Key Dates

Operational Rules and Process Changes (Annual Cycle)	2001
Train Personnel and Implement Recommendations (Annual Cycle)	2002

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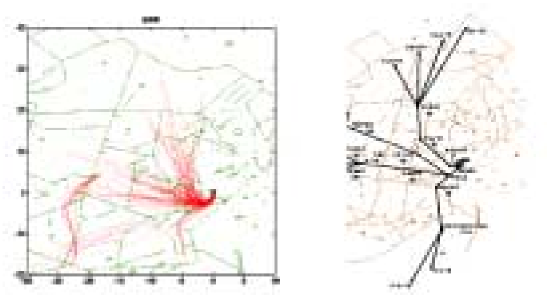
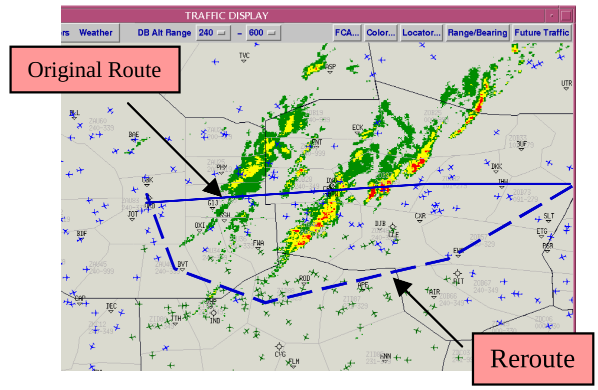
EW-2: Respond Effectively to Hazardous Weather

Timely identification of en route impacts, improved route predictability, and improved route flexibility through more alternative routes.



Terminal Area



En Route

Background

Today's route management remains relatively inflexible due to rigid airspace design, continued use of ground based Navaids, and incompatible databases and automation systems between users flight plan systems, FAA HOST requirements, and aircraft navigation systems. Flight plan route changes are workload intensive for all stakeholders resulting in increased flight delays, and cancellations. Advanced aircraft navigation systems have remained largely unused due to an inflexible airspace structure. Poor communication of route and airspace status continues to plague the system resulting in inefficient use of available resources. Additionally, the inability to communicate flight plan changes quickly and in bulk for major traffic flows also slows the process.

Ops Change Description

Operationally, route management will become a simplified task for all stakeholders. Common identification of impacted airspace utilizing tools such as the Collaborative Convective Forecast Product (CCFP) to identify weather impacts in concert with tools such as the Flow Constraint Area (FCA) tool, highlight the problem. Activating alternative route options utilizing the National Playbook or Coded Departure Routes ensure a quick implementation of a solution. The development of alternative routes including area navigation (RNAV), low altitude routes, and use of available military airspace, will make airspace available during situations where normal routes are congested or impassable due to weather conditions.

Route management should be a collaborative effort between the FAA and users to ensure safety of flight (relative to fuel, hazardous weather, etc.) as well as to ensure that traffic volume and complexity concerns are considered to ensure safe separation of aircraft from aircraft. The roles and responsibilities for route management are a key element in the S2K+1 field-training package.

Benefit, Performance and Metrics

- Improved predictability in delay, cancellation, and en-route time calculations.

- Increase on-time departure and arrival goals.
- Reduction of gridlock conditions due to limited routing solutions.
- Reduction of Miles in Trail due to efficient use of available airspace resources.
- Decrease in block times.
- Reduction in variance of execution against plan.
- Reduce fuel consumption due to extended rerouting options which maximize throughput in areas closest to the Users Preferred Trajectory (UPT).
- Reduction in flight diversions due to extensive re-route only options.

Scope and Applicability

Near-Term:

- Collaboration for identifying airspace constraints, and routing solutions utilizing DSS tools such as the Flow Contraint Area (FCA) tool and the Common Contraint Situation Display (CCSD) tool.
- S2K+1 strategic planning process, and efficient access to Canadian and Military airspace.
- Continued use and development of the Playbook for expanded options.
- Coded Departure Routes (CDRs) provide options for departure that are pre-coordinated and pre-defined so that user and FAA systems can accept them with little or no modification.
- The Low Altitude Arrival and Departure Routing (LAADR) program provides options for use of low altitude routes in situations where their normal routes at higher altitudes are unavailable.
- The Tactical Altitude Assignment Program (TAAP) is part of the National Airspace Redesign Choke Points activities.
- Define local procedures for route management in the terminal domains utilizing tools such as Traffic Management Advisor (TMA).
- Establish system wide procedures for coordinating and communicating re-route strategies both in the strategic and tactical environments. Use of the National Log for internal ATS communication, machine readable ATCSCC advisory formatting for system wide dissemination, and additions to the ATCSCC web site (e.g., the diversion recovery page), will enhance all communication.

Mid- to Long- Term:

- Additional use of area navigation (RNAV) for departures, en-route and arrival routes.
- Use of U.S. domestic reduced vertical separation minima (RVSM).
- Improved communication of route status.
- Enhanced automation for re-route solutions (e.g., FCA reroute functions or URET).
- Free Flight Phases 1/2.

Key Decisions

- Aircraft performance efficiencies and cost of using low altitude routes.
- Cost/benefit analysis for aircraft equipage for RVSM implementation.
- Compatibility and integration of automation systems between NAS users and FAA HOST.
- How to hold users accountable for “not” allowing aircraft access to the system when needed. For example, aircraft are allowed to depart even when it is known they can’t land, then delays are counted as weather or ATC.
- Pursue local MOU's for LAADR usage.

Key Risks

- Limited availability of airspace in high volume situations that often occur in the northeast during severe weather.
- Arrival and departure routing within terminal areas is limited by what can be accommodated adequately within prior environmental studies.
- Major additions to routes in terminal areas require airspace design studies including environmental impact assessments.

V3.0 (30 May 2001)

EW-2 Respond Effectively to Hazardous Weather Decision Tree

Oct 01 | 11 | 12 | 1 | 2 | Mar 02

Annual Operational Review

- Collaboration: Strategic Planning Process, Routing Solutions, Identify Constraints
- Integration of newly developed tools/procedures
  - Near Term: CDRs, LAADR, TAAP
  - Mid/Long Term: RNAV, RVSM, Enhanced Automation (FFP1, FFP2)
- Coordination and Communication of Re-route Strategies

FAA

Training

- Procedures
- Tool Use

FAA

Implementation

- Procedures - local and system wide
- Technologies - as developed
- Airspace redesign
- Operational Rules
- NRP Modifications

FAA

Compliance Assurance

FAA

Continuous Process Improvement:

Review, Implementation of Recommendations, and Training are ongoing activities following an annual cycle.